New Pathways for Equitable Solar Adoption in Texas

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SOLAR ENERGY INNOVATION NETWORK
U.S. DEPARTMENT OF ENERGY

TEPRI
Texas Energy Poverty Research Institute

TEXAS SOLAR ENERGY SOCIETY

FRONTIER energy

About SEIN

The Solar Energy Innovation Network (SEIN) seeks to overcome barriers to solar adoption by connecting teams of stakeholders that are pioneering new ideas with the resources they need to succeed. Teams that participate in SEIN receive direct funding and analytical support from U.S. Department of Energy national laboratories and participate in peer-to-peer learning with other teams tackling similar challenges.

These teams are developing and documenting their solutions for solar adoption with scale in mind so that others can adapt those solutions to their own contexts. Ultimately, the true impact of these teams' efforts will be to enable a wide array of communities to adopt solar solutions that meet their needs.

SEIN is funded by the U.S. Department of Energy Solar Energy Technologies Office and is led by the National Renewable Energy Laboratory (NREL).

Disclaimer

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Table of Contents

I. INTRODUCTION

As part of the SEIN Round 3 program, a diverse group of energy stakeholders in Texas set out to develop and pilot new pathways to increase rooftop solar adoption at no upfront cost to low-income households.

Vision: Deploy rooftop solar to households owned or rented by low-income families at no cost by pairing funds from:

- Utility energy efficiency programs
- Other federal, state, or local government funding.

Rooftop solar photovoltaic (PV) systems can provide a viable pathway to reducing energy bills for low- and moderate-income households and providing access to clean energy. While adoption of rooftop solar has gained traction over the past decade as costs of solar systems have come down, there is still a significant difference in adoption between upper- and lower-income households. A 2021 study by Lawrence Berkeley National Laboratory[1] found that while 18% of households lived in designated disadvantaged communities, these households only made up 11% of solar adopters. Additionally, TEPRI's data shows that about 40% of low- and moderate-income households in Texas struggle with paying their energy bills.[2]

One potentially promising pathway we identified involved combining funding from existing utility and federal programs promoting weatherization and energy efficiency. Our objective was to demonstrate pilot projects that equitably deployed rooftop solar to properties owned or rented by families in disadvantaged communities. Our goal was to create a clear path for low-income households to achieve electricity bill relief and to access clean energy by leveraging existing utility energy efficiency programs with existing federal resources, such as the U.S. Department of Health and Human Services (HHS) Low-Income Home Energy Assistance Program (LIHEAP) and/or U.S. Department of Energy (DOE) Weatherization Assistance Program (WAP) funding in Texas. This has been attempted in a few other states with varying degrees of success, but not yet in Texas.

Our experience suggested an opportunity for solar to meet cost-effectiveness thresholds required by WAP and LIHEAP when paired with a local utility rebate. The barrier was not the cost or reliability of rooftop solar but the lack of established pathways within these existing programs to accommodate solar. We formed a team to identify, develop, test, and promote these pathways within two regions in Texas that represent distinct energy markets.

Our team was interested in a variety of existing programs, but we had a particular interest in developing a pathway to use federal WAP and LIHEAP dollars as part of the upfront capital needed to pay for installations. We identified six primary barriers that we needed to address:

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[1] Barbose, Galen L., et al. Residential Solar-Adopter Income and Demographic Trends: 2021 Update. Lawrence Berkeley National Lab (LBNL), Berkeley, CA (United States), 2021.

[2] TEPRI, Texas Low-Income Communities Profile Report, 2019.

- Limited community awareness about the benefits of rooftop solar;
- Identification of qualifying households that both meet income qualification standards and are good candidates for rooftop solar, i.e., structurally sound roofs, energy-efficient homes, electric panels and systems that can accommodate solar, etc.;
- Per-home spending limits in WAP and LIHEAP that could be exhausted by installation of rooftop solar and/or other qualifying home energy efficiency improvements;
- Challenges in meeting savings-to-investment ratio (SIR) or other cost-effectiveness thresholds in federal and utility programs;
- Lack of program experience or state direction in using public funds for rooftop solar by the state, WAP and LIHEAP providers, and community organizations; and
- Diversity of utility/rate/regulatory structures throughout Texas.

Our team developed pilot projects in two distinct electricity markets: Carrizo Springs in south Texas and Austin in central Texas. Carrizo Springs is located within Texas' deregulated electricity market, while Austin's electricity provider is a municipally owned and vertically integrated utility. Our strategy included:

- Developing pilot projects in the two distinct markets
- Assisting the Texas Department of Housing and Community Affairs (TDHCA) with writing rooftop solar into LIHEAP and WAP plans and developing protocols for implementation
- Working closely with community groups, local utilities, and governments to pilot projects.

The Team

Our team was comprised of a diverse set of stakeholders who each played distinct roles in carrying out the pilot projects, as summarized in Table 1 and further described below.

Table 1. Summary List of Project Stakeholders

Project Stakeholder	Role
Texas Energy Poverty Research Institute (TEPRI)	Project lead
Frontier Energy	Carrizo Springs lead
- Community Service Agency of South Texas (CSAST)	Identify eligible households and sources of co-funding in Carrizo Springs
- American Electric Power (AEP) Texas	Provide energy efficiency program funds in Carrizo Springs
Texas Solar Energy Society (TXSES)	Austin lead
- Austin Area Urban League (AAUL)	Identify eligible households
- Austin Energy	Provide program funds
Other Affected Stakeholders	
- U.S. Department of Energy (DOE)	Approve state plans for WAP
- U.S. Department of Health and Human Services (HHS)	Approve state plans for LIHEAP
- Texas Department of Housing and Community Affairs (TDHCA)	Provide LIHEAP and WAP funds to sub-grantees and submit rooftop solar in state plan

Project Stakeholder	Role
- Travis County	Sub-grantee to distribute WAP and LIHEAP in Austin. Also provide general county funds to co-fund solar installations.
- Installers	Certified installers to install the solar
- Household participants	Beneficiaries of the rooftop solar systems

Texas Energy Poverty Research Institute (TEPRI): Project Lead

TEPRI is a nonprofit organization that advances equitable solutions for affordable, reliable, and clean energy for disadvantaged communities. TEPRI engages with communities and tests solutions that can support an equitable energy transition as the state integrates more diverse sources into our energy composition. The organization advances research on the energy needs of low-income consumers, develops solutions to address those needs, and establishes a network of on-the-ground relationships to enable deployment.

Role: TEPRI set the project agenda and coordinated the various activities of the project.

Frontier Energy: Carrizo Springs Lead

Frontier Energy designs, implements, and evaluates advanced energy efficiency programs for residential, commercial, and industrial clients. They work closely with Texas utilities to implement programs and provide a variety of data analytics to support them in meeting their energy efficiency goals.

Role: Frontier conceptualized and managed the project in the Carrizo Springs area.

Community Services Agency of South Texas (CSAST)

CSAST is a nonprofit community-based organization in south Texas that provides an array of housing and social support services to residents in a four-county region. Among a number of critical services, they own and manage housing, provide food program assistance, and administer energy conservation programs.

Role: CSAST manages several housing facilities for low-income residents, including one that was identified and selected for the south Texas pilot project. They also helped identify co-funding from the U.S. Department of Housing and Urban Development (HUD) that enabled the Carrizo Springs pilot project to be installed in December 2022.

American Electric Power (AEP) Texas

AEP Texas is the investor-owned transmission and distribution utility that serves the Carrizo Springs area and provides an array of energy efficiency programs to customers.

Role: AEP provided co-funding for pilot PV system installations through its Targeted Low-Income Energy Efficiency Program and provided references to qualified solar

installers and baseline solar installation requirements and procedures through its SMART Source Solar PV Market Transformation Program.[3]

Texas Solar Energy Society (TXSES): Austin Lead

TXSES is a nonprofit, statewide organization that provides education on the critical importance of solar. TXSES advocates for policies that will grow a diverse and equitable solar industry, build healthy and resilient communities, support well-paying jobs, and lay the foundation for a 100% clean energy future.

Role: TXSES coordinated the project in the Austin area and provided educational materials to the stakeholders.

Austin Area Urban League (AAUL)

AAUL is a nonprofit community-based organization that works to build a foundation for social and economic equity and equality. They provide a myriad of services, including weatherization, workforce development, health, and education programs.

Role: AAUL identified households that met both income eligibility and home structure requirements for the rooftop solar funding sources. They are also working with TXSES to provide education to community members about the benefits of solar.

Austin Energy

Austin Energy is the municipally owned electric utility that serves the City of Austin.

Role: Austin Energy is providing funding for the Austin pilot PV systems through its solar rebate program.[4]

Other Affected Stakeholders

U.S. Department of Energy (DOE): DOE requires states to submit an annual State Plan that details how they plan to distribute their WAP funds. The use of rooftop solar must be included in a state's plan before WAP funds can be dedicated toward solar installations.

U.S. Department of Health and Human Services (HHS): HHS requires states to submit an annual State Plan that details how they plan to distribute their LIHEAP funds. The use of rooftop solar must be included in a state's plan before LIHEAP funds can be dedicated toward solar installations.

Texas Department of Housing and Community Affairs (TDHCA): TDHCA worked with the team to add rooftop solar as an allowable expense in its 2023 LIHEAP and WAP State Plans.

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[3] See AEP Texas Residential Energy Efficiency Programs, https://aeptexasefficiency.com/#/residential, accessed 5/24/2023.

[4] See Solar Photovoltaic (PV) Rebate & Incentives, https://austinenergy.com/green-power/solar-solutions/for-your-home/solar-photovoltaic-rebates-incentives, accessed 5/24/2023.

Travis County: Travis County is the WAP and LIHEAP provider for Austin and helped identify other county funds that could be reprogrammed to fund rooftop solar as part of a pilot project to demonstrate the efficacy of using WAP or LIHEAP funding for solar.

Solar Installers: The solar installers must be approved by the utility that is providing the rebate. Generally, solar installers must be licensed electrical contractors and must meet other requirements of the utility solar programs, such as carrying appropriate levels of insurance and offering warranties on equipment and work performed. In Carrizo Springs, the pilot project opportunity was presented to all solar installers enrolled in AEP Texas' SMART Source Solar PV Market Transformation Program. In Austin, the project team worked with AAUL to identify minority-owned businesses that could complete the solar installation work in Austin.

Household Participants: In Carrizo Springs, the pilot households consisted of income-qualified elderly tenants living in a small multifamily apartment complex owned by CSAST. In Austin, participants are expected to be income-qualified owners of single-family homes.

II. PAIRING FUNDING STREAMS TO ENABLE SOLAR

The primary issue preventing low-income communities from reaping the benefits of solar is the upfront installation cost. Low-income families often don't have the cash or credit to pay for the installation, even if the savings would make up for the cost over time. Additionally, many low-income households don't qualify for credit, and taking on additional debt may not be prudent. However, there is energy assistance available through utility rebate programs and federal programs that could be used for rooftop solar and could become a viable and scalable solution for assisting families with lowering their energy burden. Federal assistance programs such as LIHEAP, which pay families' unaffordable energy bills year after year, could be applied to solar installations to equip families to meet more of their energy needs over the long term.

The installed price of residential (typically rooftop) solar has fallen dramatically over the past decade to a recent national median price of around $\$3.80/W_{DC}$.[5] At that cost, solar would not typically qualify for funding via the federal WAP or LIHEAP programs, even if it were listed as an eligible measure, because it is not cost-effective in most states, as determined by the SIR.[6]

Two strategies may be employed, together or separately, to nudge residential solar installations to a point where they could meet the SIR threshold and qualify for funding under WAP or LIHEAP:

- The overall cost of the solar installation may be reduced, and/or
- The required contribution from WAP or LIHEAP can be reduced.

Our project team employed both strategies in our pilot projects. Actions taken to reduce the overall cost of solar are detailed in the sections on each pilot project. To reduce the required contributions from WAP or LIHEAP, we identified other sources of funding that "bought down" the cost of solar, thereby enabling the measure to achieve an acceptable SIR.

Key Pathway

There are potentially dozens of variations of combined funding streams that could be employed to enable no-cost rooftop solar for income-eligible households, as suggested in Figure 1. Our project team decided to focus on one pathway that combines federal weatherization funding from WAP or LIHEAP with funding available from existing utility-sponsored energy efficiency rebate or incentive programs.

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[5] Tracking the Sun, 2022 Edition, Summary Brief PDF, Berkeley Lab, U.S. Department of Energy, https://emp.lbl.gov/tracking-the-sun (accessed 4/24/2023).

[6] The SIR expresses a ratio of the net present value of customer benefits (typically, electric bill reductions) over the assumed life of the measure, divided by the measure installation costs. A ratio greater than 1.0 indicates that the measure is cost-effective. Many energy efficiency and weatherization programs will not fund measures with an SIR of less than 1.0. The DOE Solar Energy Technologies Office has developed an online solar PV SIR calculator that allows WAP grantees to produce a defensible analysis of the potential cost-effectiveness of solar PV within their territory. See https://www.energy.gov/eere/slsc/downloads/savings-investment-ratio-calculator-renewables (accessed 4/25/2023).

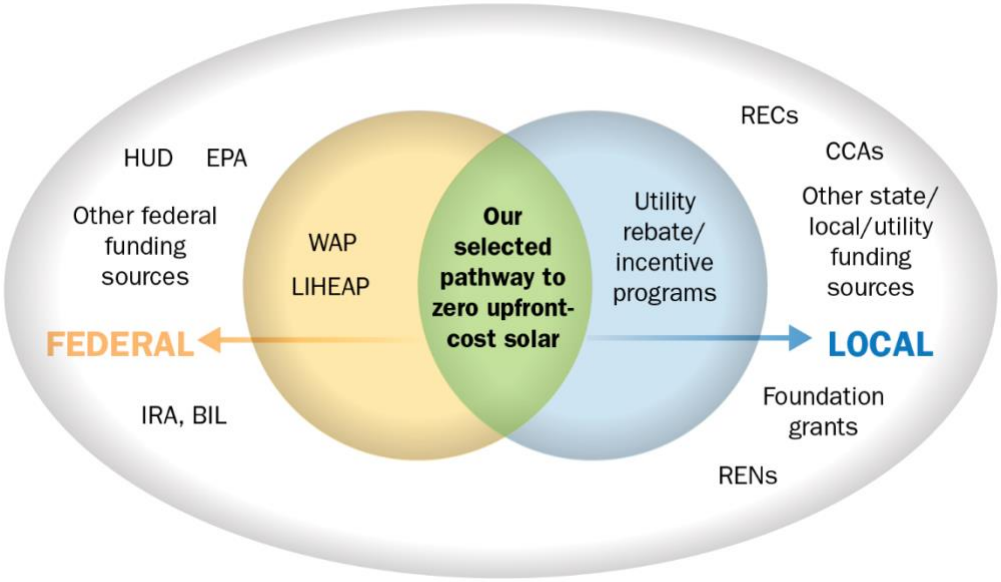


Figure 1. Examples of potential funding sources to buy down solar installation.

The federal WAP and LIHEAP programs have been consistently funded for decades and are implemented by local agencies in every state. They are long-term programs that have rules and procedures guiding eligibility for solar (although those procedures have not often been utilized). In fiscal year 2023, regular LIHEAP funding totaled approximately $3.4 billion nationally, with over $500 million available for weatherization assistance, while WAP funding totaled nearly $300 million. Together, these programs represent a large and stable stream of potential funding for rooftop solar and other weatherization measures for income-qualified households in nearly every part of the United States.

We concentrated on local utility incentive programs to pair with federal funds because these programs are also commonly available. Utility programs that offer incentives for solar installations are an obvious option, as their existence indicates that the utility is already experienced in working with solar installation companies, has developed clear interconnection policies and processes, and is generally supportive of customer-sited solar as an energy efficiency option. Utility programs aimed at supporting weatherization measures in income-qualified households may also be used to support solar, and they may be able to justify higher incentive or rebate offerings than other program types.

While other pathways present opportunities to fund solar for income-qualified households, our project team believes that this pathway—combining federal LIHEAP or WAP funding with local utility funding—presents a promising option for widespread availability and scalability nationally.

Details on a wide variety of federal and utility funding sources are described in Appendix B, with special emphasis on LIHEAP and WAP when paired with utility energy efficiency program funds.

III. OUR TEAM'S FIRST STEPS TO USING WAP AND LIHEAP

In 2022, our project team approached TDHCA to learn more about the processes and requirements for enabling local weatherization providers to use LIHEAP and WAP funding for rooftop solar.

For LIHEAP, HHS requires states to submit annual plans that detail allowable uses for the 15%–25% of funds that can be used for weatherization. The team worked with TDHCA to include language in the 2023 Texas State Plan to include rooftop solar installations as an allowable expense. In January 2023, HHS announced approval of LIHEAP funds for solar in the Texas State Plan. TDHCA expressed an interest in using our team's pilot projects to validate and better understand the selection criteria, program processes, energy savings, and bill reductions from rooftop solar.

The following sections describe the pilot projects undertaken in Carrizo Springs and Austin.

IV. CARIZZO SPRINGS PILOT

Attributes of the Region

Figure 2. Carrizo Springs location.

Carrizo Springs, the county seat of Dimmit County, is a rural community in south Texas with a population of 5,014 residents. Almost 93% of households identify as Hispanic. About 50% of the population lives at or below the federal poverty level.[7]

Community interests are primarily articulated through CSAST, which was initially founded in 1965. Its target geographical area encompasses the four counties of Dimmit, La Salle, Maverick, and Frio. CSAST was originally organized as a Community Action Agency under the Economic Opportunities Act of 1964, which was initiated by President Lyndon B. Johnson. Over the course of its fifty-year history, the mission of the agency has been to provide human development services to low-income families in the area.

Many different programs have been provided to area residents via CSAST, including the Head Start program, housing programs, food assistance (including Meals on Wheels), utility bill payment assistance, energy conservation programs, employment training programs, educational assistance programs, homeless shelters, and services for migrant and seasonal farmworkers.

Carrizo Springs is located within Texas' competitive retail electricity market. Electricity distribution service and energy efficiency programs are provided by AEP Texas, an investor-owned utility. Customers purchase electricity from various retail electric providers (REPs) that offer a multitude of different pricing plans.

The Carrizo Springs project lead, Frontier Energy, has implemented AEP Texas' solar and targeted low-income weatherization energy efficiency programs for more than a decade. Through those programs, CSAST, AEP Texas, and Frontier Energy have developed a long and cooperative working relationship.

Project Development - Strategies

The project team employed several strategies in developing the Carrizo Springs pilot project:

- Identify a target pilot project with potential for multiple, replicable installations within a small geographic area. One goal was to concentrate solar installations in a small area, with similar building ages, rooftop conditions, and electrical characteristics. Our objective was to minimize customization of installed systems and minimize the number

[7] United States Census Bureau, American Community Survey 2021, ACS Demographic and Housing Estimates, https://data.census.gov/table?q=Carrizo+Springs+city,+Texas&tid=ACSDP5Y2021.DP05 (accessed 8/3/2023).

of parties necessary to proceed. The site selected, Villa de Reposo, is owned by CSAST and provides housing to elderly residents of Carrizo Springs. The complex consists of thirteen single-story residential units distributed among five small buildings on a single property, each with up to four units per building. Each unit is individually metered for electricity (with residents selecting their own REP and paying their own electric bills), and rooftops are shared and are minimally shaded. Roof surface condition and electrical interconnection points and methods are consistent from unit to unit. CSAST's ownership of the complex simplified negotiations and decision-making.

- Base system size on energy needs and incentives. In Texas' competitive electric regions, there is no requirement for retail electric providers to offer net metering—or other plans for buying back excess electricity exported to the grid—to customers with solar. Several REPs offer such plans, but the project team wanted to ensure that the choice of a REP was entirely the customer's decision. Our plan aimed to ensure that residents would maximally benefit from the solar installed on their rooftops, no matter which REP plan they chose. One way to achieve this was by keeping the installed system size small. While typical residential solar installations average around 7–8 kW_{DC},[8] we targeted a system size of about 2 kW_{DC}. Partly, this reflects the relatively small size and energy consumption expected and observed from 1–2-bedroom apartments with elderly residents. Smaller system sizes reduce the amount of energy exported to the grid, potentially subject to widely varying REP net metering policies. By keeping system sizes small, we also reduce the overall cost of the installed systems, and thereby are less likely to surpass the per-home spending limits imposed by WAP and LIHEAP programs. Finally, while roof area was not a limiting factor in this case, keeping the system size small enabled optimization of available roof area relative to shading.
- Keep costs as low as possible. To reduce installation costs, the project team scouted and qualified multiple sites for installation, eliminating the need for a solar installer to conduct marketing and outreach. We ensured the proposed installation sites were near one another so that the installations could be planned and executed as a single job. Qualification of the site involved determining that the roof structure was able to support the solar installation, that the installation would not adversely affect any existing roof warranty, and that the electrical interconnection locations and proposed methods were acceptable to the utility. We held calls with the utility interconnection team to vet the proposed interconnection point and method prior to the preparation of a bid package (see Appendix A). The bid package defined and required a standardized system design, utilizing the same type and quantity of modules, microinverters, and racking for each installation, and requested pricing for the entire job in a consistent manner. It was distributed only to solar contractors who already met the requirements and had a positive history of working with the AEP Texas solar incentive program. Each

[8] Average installation size data derives from the AEP solar program (which Frontier Energy administers) and the CPS Energy (San Antonio) electric utility solar program (which Frontier Energy evaluates).

of these actions was taken to ensure that competitive bidding on the project scope would result in bids that were significantly less costly than typical one-off residential solar installations. Additionally, as mentioned, we scoped smaller, less expensive systems.

Bids and Contractor Selection

Frontier Energy prepared a bid package and distributed it to qualified solar installation companies during April 2022, prior to the final identification of funding sources for the project. At that point in the project timeline, we reasoned that it was best to obtain bids and indicative pricing to assist in capital planning. One solar contractor attended an on-site meeting to review the job specifications.

Three solar contractors submitted bids, with pricing ranging from \$2.32/W_{DC} to \$3.65/W_{DC}. The project team selected an experienced contractor who had worked successfully with AEP Texas' solar incentive program for many years. He was excited to begin the work, pending the project team's identification of paired funding sources.

By the time the source for the remaining capital had been identified and funding approved, several months had passed since the original bids were submitted, so we allowed the contractor to update their bid if needed. The updated bid came in at \$2.92/W_{DC}; this was to be the final project cost. Each system installed consisted of six 330-W_{DC} modules and six microinverters for a total capacity of 1.980 kW_{DC}.

Obtaining Capital and Meeting SIR Requirements

The project team had completed several economic analyses ahead of time and understood that the utility's targeted low-income weatherization program could justify the cost of solar if its share of the cost was about \$2.00/W_{DC} or less. At this level, the utility program's calculation of cost-effectiveness, also an SIR calculation, would yield a 1.0 or better, meaning that benefits outweighed costs and the project could be justified. Thus, with a bid in hand of \$2.92/W_{DC}, we needed to find a secondary source of at least \$0.92/W_{DC} for the project to proceed.

CSAST had a long relationship working with HUD on the Villa de Reposo complex and submitted a request to dedicate \$25,000 in maintenance/repair reserve funds to the solar installation—this came out to about \$0.97/W_{DC}. Once their HUD representative approved the expense, we executed a contract for the installation to begin. When it was completed, HUD mailed a check for \$25,000 directly to the solar installation contractor.

This HUD check was accompanied by a check from Frontier Energy (passing through AEP Texas targeted low-income weatherization funds) for \$50,250.

In sum, HUD's contribution of \$25,000 (\$0.97/W_{DC}) achieved a WAP/LIHEAP SIR of 3.20, demonstrating that the funding model could work with WAP or LIHEAP funds. The utility's final contribution of \$50,250 (\$1.95/W_{DC}) achieved an SIR of 1.60, sufficient to surpass that program's cost-effectiveness threshold as well. See the summary cost analysis in Table 2 and details of the cost-effectiveness calculations in Table 3.

Table 2. Summary Raw Cost Analysis, Carrizo Springs Pilot

# of Systems/Units	13
Module	Aptos 370
Capacity Rating (W/module)	330
Quantity	78
kW total	25.74
kW/system	1.980
Inverter	Enphase IQ7+
Monitoring	None
Total $	$75,250.00
$/$W_{DC}$	$2.92
From AEP Low-Income Program ($)	$50,250.00
$/$W_{DC}$	$1.95
AEP Contribution per Home	$3,865.38
Remaining ($) from Agency/HUD	$25,000.00
$/$W_{DC}$	$0.97
Agency Contribution per Home	$1,923.08

A cost-effectiveness analysis was performed using the NREL-developed Solar PV SIR calculator.[9] The model inputs for the Agency/HUD contribution are shown in Table 3. All input values are defaults except for the system cost per watt ($2.92), state grant ($1.95, representing the utility contribution to the project), proposed system size (1.98 kW_{DC}, representing the actual system capacity installed), and electricity rate ($0.15/kWh). These inputs yielded an SIR of 3.20, indicating the project is likely to surpass the WAP/LIHEAP threshold SIR given these inputs.

The calculator was also used to determine the SIR for the utility contribution. In this case, the state grant entry was changed to $0.97/$W_{DC}$ (representing the HUD contribution), yielding an SIR for the utility contribution of 1.60.

[9] See https://www.energy.gov/eere/solar/energy-related-federal-financial-assistance-programs (accessed 4/25/2023).

Table 3. Cost-Effectiveness Model Inputs for Agency/HUD Contribution – Carrizo Springs Pilot

System Details	
Cost per watt (DC-STC)	$2.92
Analysis period (years)	30
Degradation rate (per year)	0.75%
Market assumptions	
Electricity and Operations & Maintenance (O&M) rate escalation	2.3%
O&M costs ($ per kW/yr)	$29
Social discount rate	3.0%
Federal and State Incentives	
Federal Investment Tax Credit (ITC) taken	0%
State incentive ($/kWh)	$0.00
Years of incentive (years)	
Summary	
State grant ($/W)	$1.95
Proposed system size (kW)	1.98
Economics	
Capacity factor	17%
Electricity rate ($/kWh)	$0.15
SIR	3.20

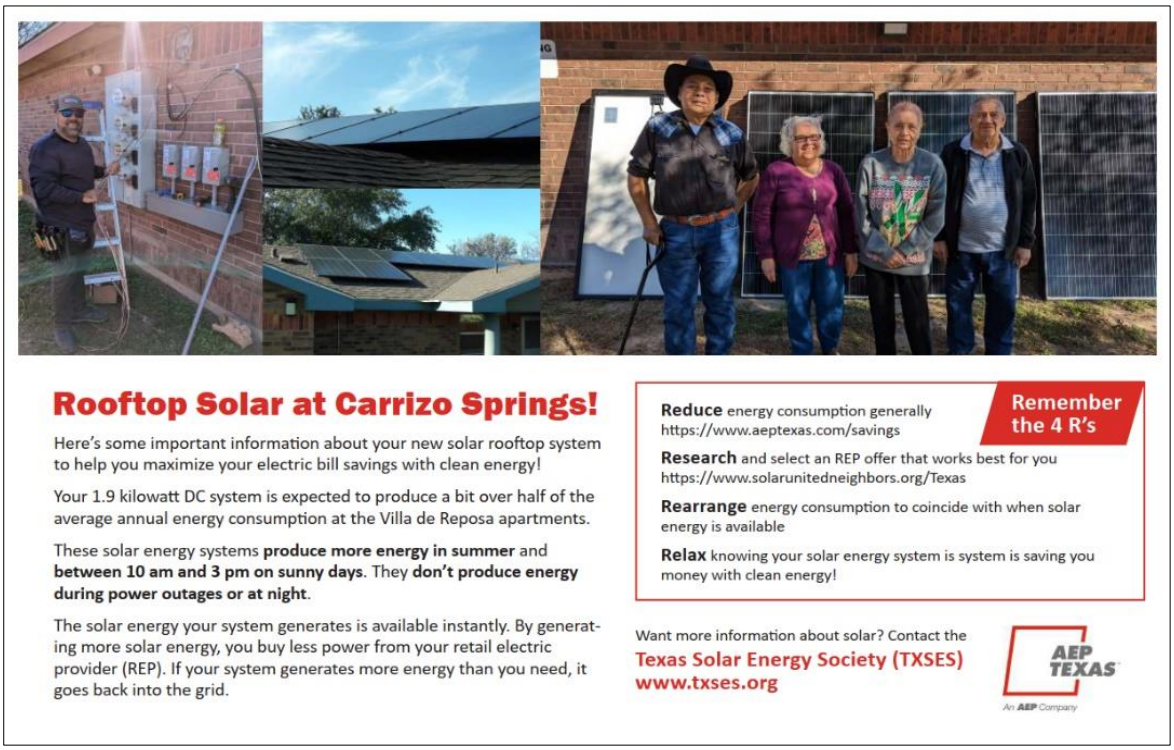
Outcomes

The Carrizo Springs pilot project resulted in the installation of thirteen independent 1.980-kW_{DC} solar energy systems at the Villa de Reposo elderly housing complex in Carrizo Springs in December 2022. HUD and utility funds were delivered to the solar contractor by the end of the calendar year. On average, these systems can be expected to offset approximately 30%–60% of the annual energy use in individual units.

During the installation, CSAST arranged for visits by members of its Board of Directors and others in the community to view the solar panels and installation. Informal question and answer sessions and discussions with many of the residents about the installation occurred throughout the installation.

Frontier Energy worked with TXSES to develop educational materials in English and Spanish to help educate residents on how to maximize the value they obtain from their solar energy system (see Figure 3). These flyers were delivered along with a sunshine magnet to attach to residents' refrigerators. At the time of this writing, we are working with CSAST to offer more formal training on what to expect from the solar energy systems.

Frontier Energy is also working with AEP Texas to obtain pre- and post-installation meter reads to verify the systems are working as expected and to quantify the likely bill savings for residents. This work is expected to be completed by the end of June 2023.



Rooftop Solar at Carrizo Springs!

Here's some important information about your new solar rooftop system to help you maximize your electric bill savings with clean energy!

Your 1.9 kilowatt DC system is expected to produce a bit over half of the average annual energy consumption at the Villa de Reposa apartments.

These solar energy systems **produce more energy in summer** and **between 10 am and 3 pm on sunny days**. They **don't produce energy during power outages or at night**.

The solar energy your system generates is available instantly. By generating more solar energy, you buy less power from your retail electric provider (REP). If your system generates more energy than you need, it goes back into the grid.

Remember the 4 R's

Reduce energy consumption generally https://www.aeptexas.com/savings

Research and select an REP offer that works best for you https://www.solarunitedneighbors.org/Texas

Rearrange energy consumption to coincide with when solar energy is available

Relax knowing your solar energy system is system is saving you money with clean energy!

Want more information about solar? Contact the
Texas Solar Energy Society (TXSES)
www.txses.org

AEP TEXAS
An AEP Company

Solar de Azotea en Carrizon Springs!

¡Aquí hay información importante sobre su nuevo sistema de techo solar para ayudarlo a maximizar sus ahorros en la factura de electricidad con energía limpia!

Se espera que su sistema de CC de 1,9 kilovatios produzca un poco más de la mitad del consumo de energía anual promedio en los apartamentos de Villa de Reposa.

Estos sistemas de energía **solar producen más energía en verano y entre las 10 am y las 3 pm en los días soleados. No producen energía durante los cortes de energía o durante la noche.**

La energía solar que genera su sistema está disponible al instante. Al generar más energía solar, compra menos energía a su proveedor minorista de electricidad (REP). Si su sistema genera más energía de la que necesita, regeresa a la red.

Recuerde las 4R

Reduce el consumo de energía en general https://espanol.aeptexas.com/savings/

Revise/Investigue y seleccione una oferta de REP que funcione mejor para usted https://www.solarunitedneighbors.org/en-espanol/

Reorganize el consumo de energía para que coincida con la disponibilidad de energía solar

¡Relájese sabiendo que su sistema de energía solar es un sistema que le está ahorrando dinero con energía limpia!

¿Quiere más información sobre la energía solar?
Comuníquese con
Texas Solar Energy Society (TXSES)
www.txses.org

AEP TEXAS
An AEP Company

Figure 3. English and Spanish educational flyers developed for residents of the Villa de Reposo apartments in Carrizo Springs.

V. AUSTIN PILOT

Attributes of the Region

Austin is the capital of Texas, the eleventh-most-populous city in the United States, and the fourth-most-populous city in Texas. As of 2021, Austin's estimated population was 964,177.

Figure 4. Austin location.

Austin has high wealth disparity, with the west side of town having significantly more resources than the east side of town, where the great majority of low- to moderate-income residents live.[10] Additionally, the overall cost of living is 1% higher in Austin than the national average, and housing costs are 18% higher.[11]

The targeted project area is low-income neighborhoods in far east Austin, as shown in Figure 5. Eligible participants must be income-qualified, meeting the requirements of being at or below 200% of the federal poverty level for WAP funding, or 150% of the federal poverty level for LIHEAP. Our community-based partner, AAUL, has a database that includes populations for income-qualified homeowners in these zip codes, as they provide an array of services to low-income residents, including building repairs and weatherization.

As a municipally owned utility, Austin Energy has a long history of innovative energy efficiency and clean energy incentives that help its customers reduce the costs of installing solar energy systems on their homes. Austin Energy's current solar rebate for qualifying customers is $2,500. The system size must be 3 kW_{DC} or larger.[12] Austin Energy's four-tier rate structure[13] allows those with lower use to have lower rates, and thus lower bills.

[10] See, for example, Phillip Issa, KUT radio, Does Austin's Economic Segregation Threaten its Charm?, https://www.kut.org/austin/2015-02-24/does-austins-economic-segregation-threaten-its-charm (accessed 5/24/2023).

[11] KVUE television, https://www.kvue.com/article/money/economy/boomtown-2040/austin-cost-of-living-higher-national-average/269-55685e48-4900-4976-8c07-6434652b8c41 (accessed 5/24/2023).

[12] Austin Energy Solar Rebate Program, https://austinenergy.com/green-power/solar-solutions/for-your-home/solar-photovoltaic-rebates-incentives (accessed 4/23/2023).

[13] Austin Energy, Residential Rates, https://austinenergy.com/rates/residential-rates (accessed 5/24/2023).

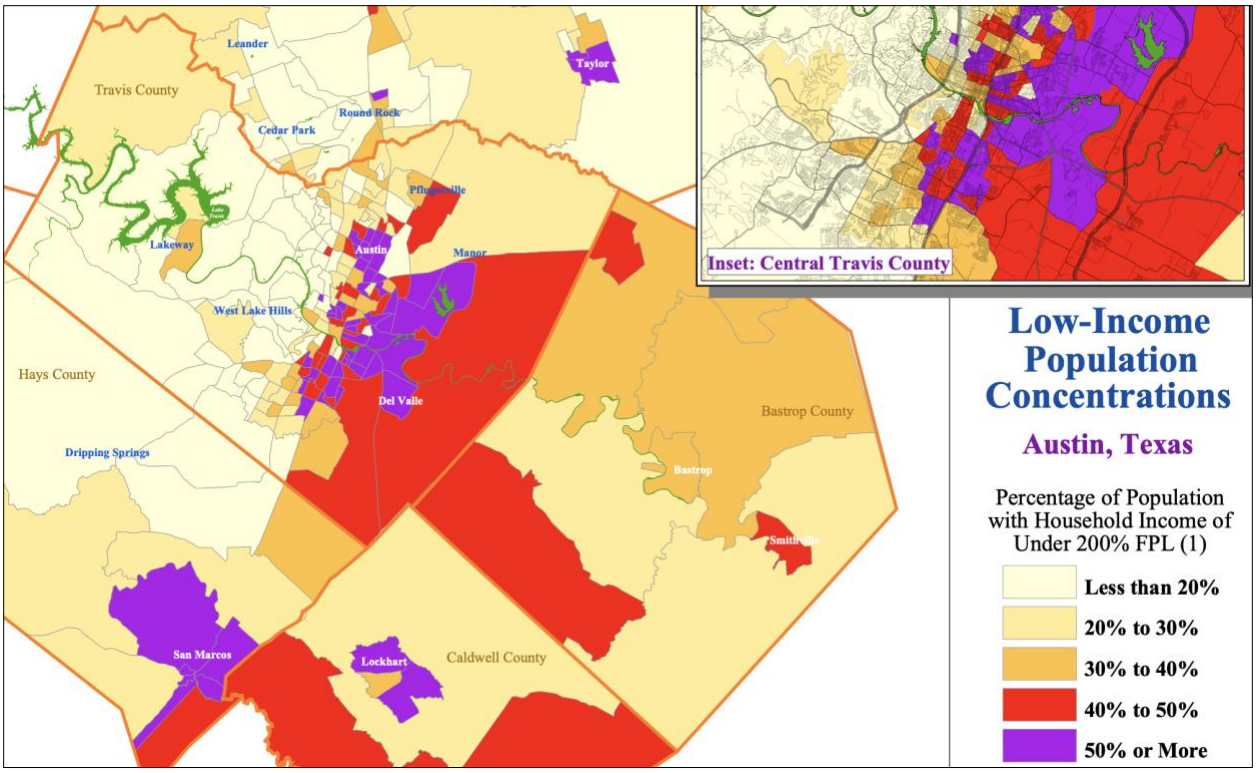


Figure 5. City of Austin:
https://www.austintexas.gov/sites/default/files/files/Planning/Demographics/MSA_2000_Series_Pov_200_per.pdf

Project Development Strategies

The Austin pilot will adapt a similar framework to Carizzo Springs. As of August 2023, the project is still deploying the strategies.

The project team is focusing on the following strategies for the Austin pilot:

- Identify ten single-family households that are ideally suited for this pilot. The team is prioritizing homes owned by residents who have already participated in energy efficiency or weatherization programs and those who have had roofing and electrical code upgrades. Homes must pass basic structural, electrical, shading, and other screening criteria to ensure they are well-suited for rooftop solar. Homes must have separate electric meters, and the occupant must pay the electric bill. Roofs must be able to support the solar system, the installation must not adversely affect any existing roof warranty, and electrical interconnection locations and methods must be acceptable to Austin Energy.

  AAUL works with homeowners in the targeted community who have participated in utility assistance programs and is familiar with the housing stock that qualifies. Residents must also be income qualified.

- Identify homes in geographic clusters to minimize installation costs by allowing installation to happen during one visit to the area.
- Provide one-on-one support to homeowners to make sure they understand how their new 3-kW_{DC} solar rooftop system works to maximize electric bill savings. Once the ten single-family dwellings that are suited for this pilot are identified, the next step will be to reach out to the homeowners to determine interest and hold a meeting to explain the project in detail in order to manage homeowner expectations, e.g., the system will not cover the entire cost of their electric bill, nor will it provide power when the grid goes down. All educational materials will be developed by TXSES in English and Spanish.

Bids and Contractor Selection

AAUL will be the official installer of record. They will oversee all ten systems under the leadership of a master electrician. Only participating solar contractors are eligible to offer Austin Energy's rebate and incentives to customers who install solar power on their homes or businesses. To remain on the participating contractors list, contractors must abide by the Austin Energy Code of Conduct and Ethical Requirements and the Austin Energy Solar Incentive Program Contractor Handbook.

AAUL will be responsible for securing bids for applicable solar rooftop systems and microinverters. To ensure the best possible pricing, all systems and microinverters should be the same. To maximize the systems' output, homes with the best tilt and orientation will be chosen.

The rooftop solar energy systems will carry warranties as specified by the utility programs. This includes a warranty for a minimum of ten years (workmanship and equipment), plus manufacturers' warranties of twenty-five years on the solar panels. For the other major system component—the DC-to-AC inverters—we will use micro-inverters that mount to the underside of the solar panels. These inverters typically come with a twenty-five-year warranty to match the panel warranty. The Texas Technical Reference Manual (TRM)[14] specifies a thirty-year life for rooftop solar.

Obtaining Capital and Meeting SIR Requirements

The total cost for the 3-kW_{DC} system is projected to be $9,000/home. Austin Energy's solar rebate is $2,500 ($0.83/W_{DC}). The upfront cost for the rebate will be paid by AAUL and reimbursed from Austin Energy under a third-party receivership.

Expected maintenance costs are generally low and are considered within the DOE SIR calculations used for WAP calculation based on historical experience. Installer and manufacturer warranties limit risk.

[14] The Texas TRM specifies savings algorithms shared by utilities in evaluating energy efficiency program offerings. PV Watts is the specified tool for calculating rooftop solar savings. See http://texasefficiency.com/index.php/emv.

The team used NREL's economic analysis tool to determine SIR cost-effectiveness. Like the Carrizo Springs project, we calculated the SIR of the non-utility contribution (in this case county funds) to be 1.06, demonstrating that at these assumed costs the project would be viable under WAP or LIHEAP. See expected funding sources in Table 4.

Table 4. Anticipated Funding Sources, Austin Pilot

Pilot Funding		**Sustainable statewide program**
$2500 Austin Energy solar rebate	homeowner bill savings data to State	$2500 Austin Energy solar rebate
$6500 Travis County		$6500 from State via LIHEAP and/or WAP
$9000 total project cost		$9000 total project cost

Cost-effectiveness analysis was performed using the NREL-developed Solar PV SIR calculator.[15] The model inputs for the non-utility contribution are shown in Table 5. All input values are defaults except for the system cost per watt (assumed at $3.00), state grant ($0.83, representing the Austin Energy contribution to the project), proposed system size (3.00 kW_{DC}, representing the proposed system capacity installed), and electricity rate ($0.15/kWh). These inputs yielded an SIR of 1.44, indicating the project is likely to surpass the WAP/LIHEAP threshold SIR given these assumed inputs.

[15] See https://www.energy.gov/eere/slsc/downloads/savings-investment-ratio-calculator-renewables (accessed 4/25/2023).

Table 5. Cost-Effectiveness Model Inputs for Non-Utility Contribution – Austin Pilot

System Details	
Cost per watt (DC-STC)	$3.00
Analysis period (years)	30
Degradation rate (per year)	0.75%
Market Assumptions	
Electricity and O&M rate escalation	2.3%
O&M costs ($ per kW/yr)	$29
Social discount rate	3.0%
Federal and State Incentives	
Federal ITC taken	0%
State incentive ($/kWh)	$0.00
Years of incentive (years)	
State grant ($/W)	$0.83
Summary	
Proposed system size (kW)	3.00
Total purchase price	$ 9,000
Economics	
Capacity factor	17%
Electricity rate ($/kWh)	$0.15
SIR	1.44

The calculator was also used to determine the SIR for the utility contribution. In this case, the state grant entry was changed to $\$2.17/W_{DC}$ (representing the non-utility contribution), yielding an SIR for the utility contribution of 3.75.

Anticipated Outcomes

Frontier Energy will perform energy savings assessments after installation of the ten homes in the pilot program. Once this information has been collected and passed to TDHCA, TXSES will continue working with TDHCA to ensure a long-term model.

While the Austin Energy pilot project is still in development, three notable outcomes can be highlighted:

- Currently, there are no Austin Energy approved minority-owned solar installer companies in Austin. One of the long-term goals of this pilot is to expand opportunities for minority-owned businesses.
- In addition to the Austin Energy rebate and state funds, we also pursued Travis County as a source of funding. We asked the Travis County Commissioners Court for permission to move unused septic repair funds to a program that would allow us access. We are

currently working with county staff to develop protocols once the funding has been approved by the commissioners.

- Once the solar systems of the ten homes are up and running, we will capture the installation costs along with resulting energy and utility bill savings and pass that information to the state.

VI. CONCLUSION

What Worked, and Why?

Our team's SEIN project lasted sixteen months. We were able to complete installations in Carrizo Springs and hope to begin installations in Austin in late 2023. The elements that helped our projects move forward included:

- We started with the end goal in mind. We began pricing systems and installers to understand what funding we would need to identify for the project.
- We brought the local utilities in each market onto our teams to understand the solar rebates available in our markets, and to understand what certifications they required of installers.
- We developed a relationship with our state agency to assist with putting the supportive language in the state's annual LIHEAP Plan.
- We tested a funding model using various sources to demonstrate that rooftop solar could be provided to low-income households while meeting all WAP and LIHEAP funding criteria. Our pilot projects provided evidence to the state that there are households that meet the criteria for WAP and LIHEAP and can benefit from rooftop solar.

What Actions Lie Ahead?

- The project team approached TDHCA early in 2022 to ask them to add language allowing rooftop solar as an allowable use of LIHEAP funds in the LIHEAP Plan. The plan was approved by the U.S. Department of Health and Human Services in January 2023. We will now work with TDHCA to design parameters for use. We will also collect data to validate that homeowners see a reduction in their electric bills to determine best practices for moving forward.
- We will continue to move forward with the Austin project to access county funds, identify qualifying households, educate homeowners, and install solar.
- We plan to evaluate achieved energy and electric bill savings, as well as the customer experience and satisfaction with the installations, in both markets.

Additional Considerations

For those that are interested in replicating this process, the following is a list of activities to consider:

- Contact the state agency that manages WAP and LIHEAP funds early to discuss the prospect of including rooftop solar as an allowable expense in the annual State Plans that they submit to DOE and HHS. Work with the state to understand what they would like to see from initial projects that would enable them to move forward.
- Partner with an established community-based organization that provides energy efficiency, weatherization, and/or housing services. They should be equipped to manage

installers and identify households that meet the criteria. Organizations that are the local purveyors of WAP and LIHEAP funds are ideal.

- Build a relationship with your local WAP and LIHEAP provider to work with the project partners on accessing the mix of funding sources when they become available.
- Build a relationship with your local utility to ensure that they provide a rebate or similar incentive and are supportive of the program.
- Seek alternative sources of public funds that could be included in a funding model/strategy that shows how WAP and LIHEAP funds could be applied to pay for rooftop solar in order to reduce electricity bills for low-income households.

APPENDIX A: PROJECT CHECKLIST

IDENTIFY FUNDING

☐ Identify potential funding to help pay for the cost of managing a pilot project. A pilot project will take extra time to define and coordinate the various stakeholders.

DEVELOP RELATIONSHIP WITH STATE AGENCY

☐ Identify your state agency and agency staff members that manage the WAP and LIHEAP funding.

☐ Assist state agency staff members in adding "rooftop solar" as an allowable expense in their annual State Plans that they submit to HHS and DOE.

☐ Work with state agency staff to understand if there are specific case studies that would assist them in developing protocols for local providers.

DEVELOP RELATIONSHIP WITH LOCAL UTILITY

☐ Contact your local utility to understand what rebates may be available for rooftop solar.

☐ Work with your local utility to explore any additional rebates that may be available for low-income customers or ask them if they might be flexible in providing funds upfront or to a local nonprofit partner to be used to install solar.

PREPARE PRELIMINARY INFORMATION

☐ Develop a clear set of criteria for households to qualify for rooftop solar at no cost. This includes:

- Meeting the income requirements for WAP, LIHEAP, or/and other forms of subsidy that you want to access.
- Whether the household has maxed out on their utilization of WAP or LIHEAP funds and would therefore not be eligible for using this source to pay for the rooftop solar.
- Structural issues such as roof condition, roof pitch and orientation, and home weatherization.

☐ Identify solar installers that are approved by the utility to do this work. There are usually extra certifications required:

- Price systems and installers to understand the funds you will need to identify for the project.
- Ask if the pricing can be lowered by identifying homes that are clustered together.

☐ Identify all potential sources of funding that can be used to pay for the systems and installation.

☐ Explore whether you want to use the project to help qualify BIPOC solar installers to participate in your program. If that is the case, identify a nonprofit that can assist you with this process.

DEVELOP RELATIONSHIPS WITH LOCAL NONPROFITS WHO WORK IN WEATHERIZATION OR/AND HOUSING

☐ Identify and develop relationships with nonprofits that work with low-income households on home repair, weatherization, housing, WAP, and/or LIHEAP. These nonprofits can assist in identifying qualifying households that meet both the income and structure requirements.

☐ Work with a nonprofit partner to develop educational materials about rooftop solar installation, maintenance, and benefits.

☐ Develop a method for collecting energy bills of participating households before and after installation to evaluate savings.

☐ Develop a relationship with household participants to be able to collect information on their experience that can be shared with all stakeholders to improve the program going forward.

APPENDIX B: FUNDING SOURCES

Federal Funding Sources

Weatherization Assistance Program (WAP)

The Weatherization Assistance Program (WAP), funded by the U.S. Department of Energy (DOE), provides technical and financial assistance to help low-income residents reduce their energy bills by making their homes more energy efficient. Federal funding is passed to local subrecipient agencies who implement the program directly. WAP agencies perform energy audits and install audit-recommended energy efficiency measures (those with an SIR of greater than 1.0) to help families maintain energy-efficient, safe, and healthy homes. Families with incomes at or below 200% of the federal poverty income level are federally eligible for WAP benefits.

Typical weatherization measures may include insulation, duct sealing, refrigerator replacements, heating and cooling system repairs or replacements, air infiltration mitigation, and reducing electric baseload consumption through measures such as energy-efficient lighting and appliances. These services can save a low-income family between $250 and $450 annually in energy costs.

WAP allows for approximately half of the available benefits for households receiving weatherization services to be used for solar. However, a primary focus of WAP is to ensure families receive maximum benefits stemming from weatherization; solar can be a part of the WAP toolkit to offer relief to families suffering from high energy burdens.

When our team began the SEIN Round 3 project, individual states were required to petition DOE for solar to become an allowed measure in their state.[16] Due to the cost of solar and the complexity of applying to DOE, only a handful of states had attempted to do so, and with varying degrees of success.

In March 2023, DOE updated its guidance for solar in WAP, simplifying the process to include solar in statewide WAP implementation plans. The guidance revised the energy audit approval procedures affecting rooftop solar, encouraged grantees to leverage opportunities to share the cost of installing solar in weatherization projects, and provided a template for requesting permission to include solar as an eligible measure.[17] We expect these changes will make integration of solar options within WAP more accessible by many states.

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[16] See Juliana Williams and Jeff Cook, National Renewable Energy Laboratory (NREL), *Solar Deployment in LIHEAP and WAP: Policy and Project Updates*, May 2023, https://nascsp.org/wp-content/uploads/2023/05/NREL_NASCSP-Solar-in-WAP-2023.potx.pdf (accessed 5/24/2023).

[17] Weatherization Program Notice (WPN) 23-6: Revised Energy Audit Approval Procedures, Related Audit and Material Approvals Including Fuel-Switching and Solar PV; https://www.energy.gov/scep/wap/articles/weatherization-program-notice-23-6-revised-energy-audit-approval-procedures. See also "SECTION 3: USE OF WAP FUNDS FOR SOLAR PV SYSTEMS" (March 3, 2023). For additional guidance related to using leveraged resources, refer to Managing Multiple Funding Streams within the Weatherization Assistance Program. https://www.energy.gov/scep/wap/articles/weatherization-program-notice-22-9-managing-multiple-funding-streams-within (June 24, 2022). See also WPN 23-6 Attachment 4: Optional Solar

Low-Income Home Energy Assistance Program (LIHEAP)

The Low-Income Home Energy Assistance Program (LIHEAP) is a program of the U.S. Department of Health and Human Services (HHS) but is administered by state and local agencies. LIHEAP helps families with home energy bills, energy crises, weatherization, and energy-related minor home repairs. Families with incomes between 150% and 185% of the federal poverty income guidelines or, if greater, 60% of the state median income, are federally eligible for LIHEAP benefits. States may adopt lower income limits, but no household with an income below 110% of the poverty guidelines is allowed to be turned away from the program.

The LIHEAP statute allows for energy aid agencies to use up to 15% of funds, and up to 25% with a waiver, for weatherization activities, which can include solar. To use funds for solar, the LIHEAP statute states the need to demonstrate "measurable savings in energy expenditures by low-income households."

States choosing to consider solar within LIHEAP must declare that intent in their annual statewide implementation plan. The process for doing so is simple; however, the implementation of solar as a measure must meet all other program requirements. For example, the LIHEAP contribution to a solar installation must be cost-effective, and solar installation contractors must be selected in accordance with federal procurement standards. Some states simply grant their LIHEAP weatherization funds to WAP implementers.

In our Carrizo Springs pilot project, we did not utilize WAP or LIHEAP funds because the TDHCA had not yet received approval, nor had they yet developed clear processes and procedures, to utilize such funding for solar projects. TDHCA did incorporate solar into its 2023 LIHEAP plans, opening the possibility of incorporating those funding systems in future projects. Our Austin pilot project is also moving forward in 2023 without any expectation of LIHEAP co-funding availability. Both pilot projects are intended to demonstrate to TDHCA how rooftop solar can be successfully integrated with WAP and LIHEAP.

Other Federal Funding Sources

Other federal funding sources may also be available. In one of our pilot projects, the federal component of funding was identified by the local housing authority, which was able to dedicate repair/maintenance reserve funds from the U.S. Department of Housing and Urban Development (HUD) to a solar project. The local housing authority requested the funds using HUD Form 9250,[18] and the request was approved. (In this case, we treated the HUD funds in the same manner as LIHEAP or WAP funds, ensuring that the project met all program and cost-effectiveness thresholds required by LIHEAP or WAP.)

PV Initial Request Template, https://www.energy.gov/sites/default/files/2023-03/OPTIONAL_Solar%20PV%20Initial%20Request%20Form.docx.

[18] For HUD-insured mortgages, 24 CFR Part 880.601 and 24 CFR Part 880.602 authorize the Secretary of the Department of Housing and Urban Development to monitor withdrawals from the Reserve for Replacements and/or Residual Receipts Funds. Form 9250 is the form used to request such withdrawals.

Other federal funding sources may also be applied to solar. The Database of State Incentives for Renewables and Efficiency (DSIRE) website[19] currently lists 32 different federal financial incentives and regulatory policies, many of which support residential solar development.

Local/State/Utility Funding Sources

Funding from local, state, and utility sources can most often be matched against federal funds.

Utility Incentive or Rebate Programs

Many utilities offer incentive or rebate programs designed to encourage customers to choose more energy-efficient options for their homes or businesses. Most commonly, these programs provide a discount on highly efficient appliances, HVAC systems, or other home efficiency measures such as insulation or solar. Discounts may be paid directly to the homeowner or to their contractor (typically with savings passed through to the customer).

In Carrizo Springs, AEP Texas, the local utility, offers a suite of energy efficiency programs to its customers. Among them are a solar incentive program, which offers a rebate of up to $3,000 for installation of residential rooftop solar, and a home weatherization program targeted toward income-eligible customers. The home weatherization program does not require the customer to contribute toward the cost of eligible retrofits. Each home is assessed on measures that are cost-effective; i.e., those with a savings-to-investment ratio (SIR) greater than 1.0 are selected for installation.

In Austin, Austin Energy also offers a suite of energy efficiency programs to its customers, including a solar program, which offers rebates of up to $2,500 for residential rooftop solar.

These are examples of utility offerings leveraged, or planned to be leveraged, by our project team. Utility offerings vary widely depending on statutory and regulatory requirements, which vary by state and region.

It is important to note that some utility program designs might not call out solar specifically as an incentivized measure but may still be applied toward solar installations. For example, "standard offer programs" often define incentives based on the annual energy and/or demand savings that materialize from a wide variety of energy efficiency measures, which may include solar. Some of these programs offer higher incentive rates when the installation is performed for income-qualified households. Interested parties should check with their local utility to see whether such opportunities for co-funding exist, and if so, how much they might be able to contribute to a solar installation.

Other Local or State Grants or Programs

Other funding opportunities may be available to support local or state goals regarding grid resiliency, electrification, decarbonization, energy transition programs, jobs, and other goals. As an example, in some jurisdictions, renewable energy credits (RECs) derived from solar

[19] Database of State Incentives for Renewables and Efficiency (DSIRE), federal incentives, https://programs.dsireusa.org/system/program?state=US (accessed 5/24/2023).

installations have significant value that could be applied to a solar installation project to reduce the required federal contribution from WAP or LIHEAP.

In Austin, our project team identified and is in the process of securing co-funding from another program in Travis County that had unspent funds.

A good resource to find out more about available local utility, state, and local government programs is DSIRE.[20]

[20] DSIRE database, NC Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency® - DSIRE (dsireusa.org) (accessed /25/2023).

APPENDIX C: AUSTIN SOLAR EDUCATION PIECE

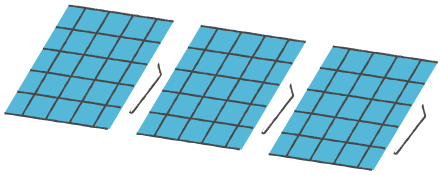
The Austin Homeowner Solar Project

Project Scope

Solar energy is an abundant, readily available renewable energy. Using solar panels, light from the sun can be converted into electricity to help power homes and businesses. Solar energy systems are a great way to satisfy the world's energy needs while being affordable and environmentally-friendly.

A local group of home energy experts is developing a 10-home pilot program that will result in the installation of small solar installations on rooftops on homes that meet the necessary criteria. Partners in this effort include:

- Austin Area Urban League
- Austin Energy
- Travis County Weatherization Program
- Texas Solar Energy Society
- Texas Energy Poverty Research Institute
- Houston Advanced Research Center (HARC)



Funding & Qualifications

Funding for the pilot program is being provided by Austin Energy's solar rebate program and the federal government. With this funding, the selected pilot homeowners will not be required to pay anything for the installation ($0 cost to clients). Solar panel program recipients can also expect that the solar panel installation will come with a 5-year warranty on all workmanship, and a 25-year warranty on major equipment.

To qualify to participate in the pilot program, homeowners will need to:

- Meet a certain income level
- Own their home, with a roof that is in good shape (evaluated by a contractor)
- Roofing has minimal shading
- Electrical main home panel board that can accommodate the solar installation

The installations will consist of 8-12 solar panels and will require roof area of about 12 by 16 feet. These installations are expected to produce about one-third of the electricity used by an average Texas home each year.

Solar panel installation will not eliminate the entire cost of the homeowner's electricity bill but will reduce the amount of electricity provided to the home by the electric utility. Reductions in purchased electricity and bill savings will be different for each home, and will depend on a variety of factors, including individual home energy use patterns, future electricity costs, and utility billing policies.

HARC FRONTIER energy TEPRI TEXAS SOLAR ENERGY SOCIETY Austin Area Urban League *Empowering Communities. Changing Lives.*

APPENDIX D: CARRIZO SPRINGS BID PACKAGE

Project Summary

Villa de Reposo Apartments is a 13-unit apartment complex serving income-eligible tenants, located at 2nd and Nopal streets in Carrizo Springs, Texas. This complex is owned by the Community Services Agency of South Texas (CSAST) and has been selected to participate in a pilot solar installation under a project titled *New Pathways for Equitable Rooftop Solar in Texas*. Project partners include CSAST, AEP Texas, the Texas Energy Poverty Research Institute (TEPRI), and Frontier Energy (Frontier). This effort is one of eight teams from across the country selected by the National Renewable Energy Laboratory (NREL) to join the third round of the Solar Energy Innovation Network (SEIN). The project team seeks to cost-effectively install 13 small (1–2-kW_{DC}) rooftop solar photovoltaic systems on the rooftops of these apartments, utilizing funding provided by AEP Texas' Targeted Low-Income Weatherization program and other sources.

Project Description

- **Building and rooftop layout.** The complex consists of 13 apartment units located in five different buildings. Four buildings contain three units each, while the fifth building contains an office plus one apartment unit. Existing asphalt shingle roofs are in good condition. Roofs slopes are approximately 15 degrees, while primary orientations suitable for solar arrays are approximately 110, 200, and 290 degrees.
- **Shading and array layout.** Several large trees create shading on some of the roof space. Individual solar arrays can be located anywhere on the building to maximize solar exposure—i.e., each array need not be located directly above the unit to which it will supply electricity, but it should be located on the building containing the unit to which it will supply electricity.
- **Electrical layout.** Each unit is independently metered by AEP Texas, and each building has a meter bank located at one end of the building. Each unit has an electrical panel located inside the unit. Photos of meter banks and in-unit electrical panels are provided in Figures 4, 6, and 8. Bidders should propose a location for interconnecting each system to the grid. Each interconnection will be made on the customer's side of the utility meter.
- **Solar metering.** No additional solar meter is required.
- **Local permits and utility interconnection.** The contractor is responsible for completing all local permitting and utility interconnection requirements.
- **Preference for AC modules or microinverters.** In order to reduce the clutter of equipment mounted outside the building, as well as minimize potential downtime, the use of AC modules or microinverters is preferred.
- **Preference for monitoring systems.** We request information on system performance monitoring be made available to the customer, and to CSAST/Frontier.

Scope of Work - Required Elements

All bidders shall be required to complete and return the attached bid package that meets, at a minimum, the following requirements.

1. Design/build 13 1–2-kWdc PV systems interconnected to the customer's side of each utility meter. All arrays/systems must be identical in size and equipment used, though they may vary in tilt/orientation. Individual solar arrays can be located anywhere on the building to maximize solar exposure—i.e., each array need not be located directly above the unit to which it will supply electricity, but it should be located on the building containing the unit to which it will supply electricity.
2. All equipment requirements applicable to the AEP Texas Solar PV Incentive Program apply.
3. PV systems shall be fully compliant with the National Electric Code (NFPA70), all required permits shall be the responsibility of the bidder to identify and obtain, and all electrical work shall be conducted by licensed electricians in accordance with Texas law.
4. The contractor shall coordinate with AEP Texas to fulfill all requirements pertaining to interconnection and utility metering.
5. System design and installation shall be warranted by the Bidder for a minimum of five years from the date of installation. Solar modules shall have a minimum 20-year warranty against undue degradation, and inverters shall have a minimum five year warranty from the manufacturer.
6. Frontier and AEP reserve the right to reject all bids.

Bidding Instructions

Bids are due by <time> on <date>.

Bidders must direct all questions to <contact name, title, company, email addresses>.

A visit to the project site will be facilitated by <organization> on <date>, from <time>. If you want to attend the site visit, you must RSVP to <email address> by <date>. If no companies respond by the deadline, the Friday site visit will be cancelled.

Bidders must review all information in this document, review reference photos and fill out and return the:

1. Contractor Bid Form
2. Any supporting information.

Submit the completed bid package to <contact name, title, company, email address>.

Contractor Bid Sheet – <location>

Contractor Company Name: _____
Contact Name: _____
Contact Phone: _____
Contact Email: _____

Proposed system specifications:

	Apartment												
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	E1
Module make/model/DC_{STC} wattage													
# of modules/system													
Inverter make/model													
# of inverters/system													
Racking system make/model													
Array tilt (degrees)													
Array orientation (degrees)													
Estimated shading (%)													
Proposed method and point of interconnection													

☐ Attach a site layout map showing the proposed array locations and other pertinent data.

☐ Attach a one-line electrical diagram showing the proposed electrical design of one system.

☐ I have read the bid package and scope of work and affirm this proposal meets all stated requirements.

Estimated construction start date (assuming go-ahead by <date>): _____
Estimated time to completion (days): _____

Bid price (all <number of> systems, turnkey delivery to <company>, 5-year warranty): _____ Payment terms: _____

Bid alternatives (equipment only, third-party ownership, leasing, other) – describe on an additional page.

Return this completed form to: <contact name, title, company, email address> by <time> on <date>.

Reference Photos for Carizzo Springs

↑

Figure 1. Building layout from Google Maps.

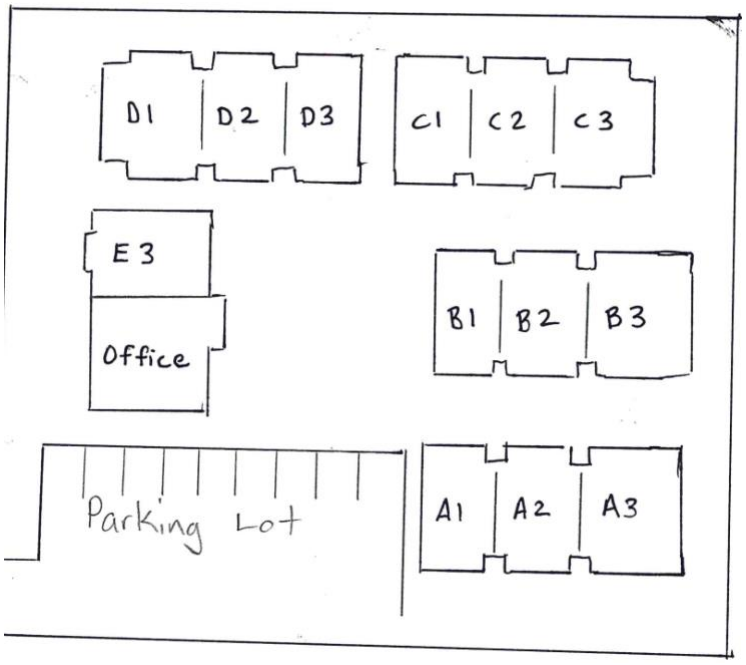


Figure 2. Apartment layout.

Figure 3. Buildings A and B from the parking lot.

Figure 4. Building B meter bank—note additional meter for common area loads. Left side of panel is locked by the utility.

Figure 5. Building C.

Figure 6. Building C meter bank—note additional meter for common area loads. Left side of panel is locked by the utility.

Figure 7. Building D.

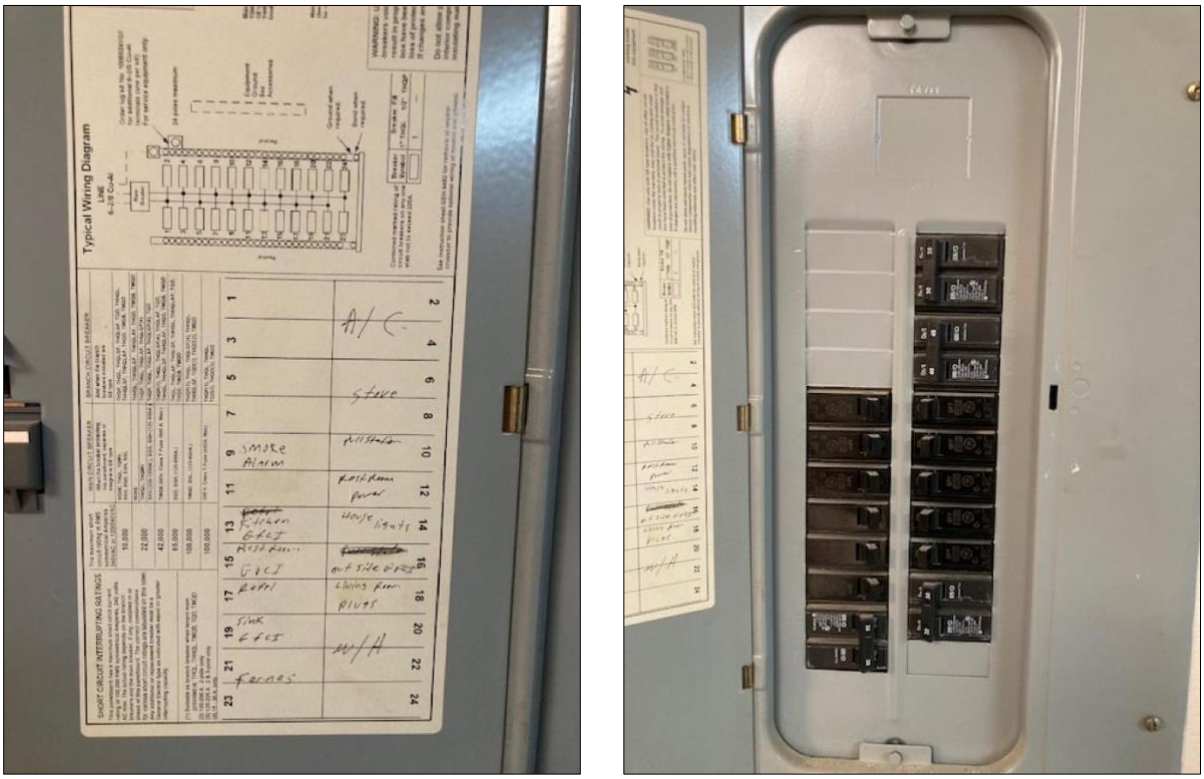


Figure 8. Typical electrical service panel located inside unit.